DOCUMENT RESUME

ED 220 662 CE 033 583

TITLE	Continuation of Employment Training for Students in the Shell Fisheries Industry. Final Report. 1981-1982.
INSTITUTION	Cape May County Vocational Schools, N.J.
SPONS AGENCY	New Jersey State Dept. of Education, Trenton. Div. of Vocational Education.
PUB DATE	82
NOTE	69p.
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	Conservation Education; Curriculum Development; *Environmental Education; *Fisheries; Job Placement; *Job Skills; *Job Training; *Performance Tests; Postsecondary Education; Secondary Education; Test Construction; Vocational Education
IDENTIFIERS	*Aquaculture; Marine Occupations; New Jersey; *Shell Fishing

ABSTRACT

A project to provide training in the shell fishing industries was continued into its second year to develop entry-level skills for employment and provide instruction and hands-on experience through infusing the existing Marine Science program. Results from a survey of instructors and individuals involved in the industry were used to develop a performance test that included a written portion. (The test is provided.) The test was used to evaluate development of entry-level skills in students. A vocational student profile for shell fishing occupations was also designed as part of the project. Other activities--field trips, direct experience--were undertaken to develop and encourage continuous preservation of unpolluted areas for aquaculture purposes. (Appendixes include maps of field trip locations, discussion of oyster growth experiments, a bibliography, and a statement of philosophy and objectives suggested for a course of study for the shell fisheries industry.) (YLB)

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ED220662

FINAL REPORT

OF

CONTINUATION OF EMPLOYMENT TRAINING

FOR

STUDENTS IN THE SHELL FISHERIES INDUSTRY

1981 - 1982

Cape May County Vocational Schools
Crest Haven Road
Cape May Court House, New Jersey

Project Director
Hans Toft
Department Head

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Project Duration: July 1, 1981 (Beginning Date)

June 30, 1982 (Ending Date)

The Contractors undertaking this project were encouraged to express fully their judgements in professional and technical matters. Points of view or opinions do not, therefore, necessarily represent official funding agency positions or policies.

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IDENTIFICATION NO. SEM 6 240 AMOUNT FUNDED 24,793

FUNDED UNDER SECTION 132 OF P. L. 94-482

PROJECT TITLE: Continuation of Employment Training for Students in the Shell Fisheries Industry

LEGAL NAME OF APPLICANT DISTRICT, INSTITUTION OR AGENCY: Cape May County Vocational School District

ADDRESS: Crest Haven Road

Cape May Court House, NJ 08210

PROJECT DIRECTOR: Mr. Hans Toft

TELEPHONE NUMBER: 609 - 465-2161
(Area Code)

ABSTRACT

DESCRIPTION OF PROJECT

(Use this sheet and no more than one other to type in single-spaced form a statement of project objectives, procedures to be followed, state and local priorities emphasized and the expected contribution of the project to vocational education.)

The objectives of these programs are: 1) to continue to develop in students the job-entry level skills for employment in the shell fisheries industry; 2) to continue to provide students with instruction and hands-on experiences in the fundamental processes of spat sowing and setting, growth data collecting, seed clams harvesting, retailing mature shellfish; 3) to develop and encourage continuous preservation of unpolluted areas for aquaculture purposes; 4) to provide global opportunities for employment from entry-level to the highly-skilled level for a wide variety of students; and to initiate a master course of study for the shell fisheries industry.

Procedures include the evaluation of student's performance on a pre-test and a post-test; involvement of project instructor and students in construction of oyster trays and crab pots and research areas for their placement, collection of oyster spat (immature oysters) and seed clams in the Delaware Bay; relocation of the immature shellfish in the student constructed aquafarm areas in Great Sound; maintenance of records concerning rate of growth, water and air temperature, loss due to parasites, time elapsed from placement to marketable size; harvesting shellfish; marketing and distribution of shellfish; field trips to polluted and unpolluted shellfish areas for observation; trips to other marine and aquaculture programs for supplementary information; utilization of print and non-print media to obtain a perspective on the shell fisheries industry and the careers related to it; counseling and job placement of project students; and the introduction of these students to the services of public and private organizations with a relationship to the industry.

ABSTRACT: (cont.)

Federal, state, and local governments have emphasized the need for developing the potentialities of estuarial areas. The Federal Department of Agriculture has been designated as the agency responsible for encouraging aquaculture, especially shellfishing. New Jersey passed the "Wetlands Act" in 1970, protecting areas vital to the shell fisheries industry from encroachment by development. A state task force on aquaculture is currently emphasizing the need to move ahead in this area. The Cape May County Planning Board has also established in its "Land Use Plan" the necessity for maintaining these essential areas. The priorities of this grant are geared to meeting the needs identified both locally and on higher governmental levels for the continuation of a unique primary industry and the ecological preservation of the areas essential to the success of that industry.

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A. Introduction

1. Need and Problem:

There is a continuing need in coastal counties to use environmental resources to the fullest, to encourage preservation of unpolluted aquatic areas, and to provide graduates of environmentally-related vocational programs with opportunities to broaden their occupational aspirations. In Cape May County, secondary and post-secondary graduates of the Marine Environmental Occupations program have traditionally been placed in a variety of jobs including those in the shell fisheries industry. A telephone survey of appropriate education agencies has indicated that there has been no formal training available in the shellfishing industry. Workers who grow and harvest oysters, clams, and crabs in the surf and back bays usually operate independently.

The first year of the project had a good initial impact. Student enrollments had increased, special needs students had been included and a great deal of interest for the second year of the project was generated. Initial funding has provided supplies, equipment, and staff expertise, but more than one year was necessary for the development of a successful program. Students in the program were able to practice aquaculture skills including seeding shellfish beds, recording growth and harvesting, and retailing the final product. Performance testing was developed but there was no opportunity to gather pre-test and post-test data. Continuation of the project has provided data. Involvement in the project has provided a variety of vocational experiences to help students choose satisfying careers.

In addition, this project has continued to balance regular Marine Environmental instruction with more in-depth study of shell fisheries industry. It would provide "career awareness and vocational education" and "job entry level skills" training as mandated by the T & E process.

2. Objectives:

The major objectives of Continuation of Employment Training for Students in the Shell Fisheries Industry have been:

a. To continue to develop in students the job-entry level skills for employment in the shell fisheries industry.

b. To continue to provide students with instruction and hands-on experiences in the fundamental processes of spat* sowing and setting, growth data collecting, seed clams harvesting, retailing mature shellfish and other skills (Table 1) through infusing but not replacing the existing Marine Science program (Table 2).

c. To develop and encourage continuous preservation of unpolluted areas for aquaculture purposes.

d. To provide global opportunities for employment from entry-level to the highly-skilled level for a wide variety of students in this unique and fundamental industry in Cape May County.

e. To initiate a master course of study for the shell fisheries industry.

3. Related Research:

On September 19, 1979, Governor Byrne signed into law the "Marine Fisheries Management and Commercial Fisheries Act" which set up the Task Forces on Aquaculture and Commercial Fisheries Development to see that the fisheries industries of this state are developed to their fullest potential.

The language of the new law clearly states that the Task Forces are to "define the roles of the various State agencies in carrying out a permanent program to promote the development of an aquaculture program and of a commercial fisheries industry." This proposal intends to carry out the early stages of preparing workers for the marine fisheries industry that is hoped to be developed from the expansion of the marine fisheries industry as proposed by the governor.

The following citations are representative of an ERIC search of approximately forty-eight studies in the ERIC system completed within

* "spat" are baby oysters

SHELLFISHING OCCUPATIONS

LEARNING EXPERIENCE/ACHIEVEMENT

Please evaluate this student by placing an "X" in the proper column	EXCELLENT	GOOD	AVERAGE	FAIR	POOR	DOES NOT APPLY
Knowledge of Life Cycles: Oyster Life Cycle						
Scallop Life Cycle						
Mussel Life Cycle						
Crab Life Cycle						
Eel Life Cycle						
Shellfish Terminology						
Equipment Identification						
Predators Species I.D.						
Shellfish Cultivation						
Sorting Shellfish - Market Size						
Use of Rake or Tongs						
Growth Data Collecting						
Proper Data Reading						
Use of Waders						
Proper Shellfish Handling						
Spat Sowing & Setting						

LEARNING EXPERIENCE/ACHIEVEMENT

Please evaluate this student by placing an "X" in the proper column	EXCELLENT	GOOD	AVERAGE	FAIR	POOR	DOES NOT APPLY
Spat Collection						
Seed Clams Collection						
Soft Shell Clam Collecting						
Locating Habitat						
Reading Tide Tables						
Making Crab Pots						
Baiting Crab Pots						
Setting Crab Pots						
Harvesting Crabs						
Equipment Proper Use/Safety						
Small Boat Handling						
Outboard Motor Use						
Winterization of Boat						
Boat Launching						
Rules of the Road						
Boating Terminology						
Use of Wet Suits for Treading Clams						

TABLE 1

LEARNING EXPERIENCE/ACHIEVEMENT

Please evaluate this student by placing an "X" in the proper column	EXCELLENT	GOOD	AVERAGE	FAIR	POOR	DOES NOT APPLY
Checked out on Scuba Equipment						
Collection of Shellfish						
Basic Snorkling						
Skin Diving/Shellfish Collecting						
Knot Work						
Pollution Factors						
Oyster Tray Construction						
Media Utilization						
Fish Market Operations						
Cash Register Operations						
Handling Money/Counting Change						
Customer Relations/ Marketing						
Shellfish/ Fish Preparation						
Career Orientation						

TABLE 2

MARINE ENVIRONMENTAL OCCUPATIONS LEARNING EXPERIENCE/ACHIEVEMENT Please evaluate this student by placing an "X" in the proper column	EXCELLENT	GOOD	AVERAGE	FAIR	POOR	DOES NOT APPLY
General Ecology						
Species List						
Food Chain & Web						
Marine Biology Terms						
Marsh Birds/Ducks I.D.						
Group of Phylums						
Fish Classification						
Fish Dissection/I.D.						
External						
Internal						
Oceanography Equipment						
Hydrometer						
Salinometer						
Oxygen Kit						
Thermometer						
Ocean Geology						

LEARNING EXPERIENCE/ACHIEVEMENT Please evaluate this student by placing an "X" in the proper column	EXCELLENT	GOOD	AVERAGE	FAIR	POOR	DOES NOT APPLY
Chart of Coastal Beaches						
Properties of Sea Water						
Physical						
Chemical						
Waves/Tides Currents						
Navigation Skills						
Buoys, Beacons, Ranges						
Scuba Skills						
Diving Techniques						
Dendrology						
Forestry						
Chain Saw/Axe						
Wildlife Management						
Wildlife - Dissecting, Identifying						
Tagging & Trapping						
Fish Market Operations						
Job Orientation						

LEARNING EXPERIENCE/ACHIEVEMENT Please evaluate this student by placing an "X" in the proper column	EXCELLENT	GOOD	AVERAGE	FAIR	POOR	DOES NOT APPLY
Customer Relations - Marketing						
Career Orientation						
INSTRUCTORS COMMENTS:						

Related Research (cont.)

the last four years and other documents from the Aquaculture Task Force. Goodwin, in 1978, described the various careers available to today's youth in tomorrow's sea including diving and off-shore industries.

Speeches presented at the Marine Occupation conference in South Portland, Maine provide an overview of availability and kinds of carreers in marine occupations. They also review problems of different harvesting techniques and various gear requirements. This project will emphasize the opportunities for youth in the shellfishing industry. It will concentrate on developing job entry level skills in this field.

The Aquaculture Task Force in its January 17, 1980 meeting expressed its intent to work toward the encouragement of the development of the fisheries industry in New Jersey and the methods of production.

The Federal Government in April, 1978 expressed concern because the United States imports more than half its fish foods per year. As a result, the Department of Agriculture has been designated as the agency responsible for encouraging aquaculture in general and shellfishing in particular.

The U.S. Department of Labor Bureau of Labor Statistics Bulletin 2001-15 Exploring Careers, Agriculture, Forestry and Fishery Occupations, 1979, has also identified aquaculture as "a rapidly growing field that offers many employment opportunities." This project proposes the aquisition of knowledge of the fundamental processes of shellfishing growth, development, and harvesting along the shoreline of New Jersey.

In the May/June, 1975 issue of Mosaic, the necessity for aquaculture linked to conservation is explored. The key role of aquaculture in supplying large amounts of food at no cost in nonrenewable energy resources is examined.

Related Research (cont.)

The "Wetlands Act" of 1970 (N.J.S.A. 13:9 A-1, et. seq.), and the "Land Use Plan" of the County Planning Board advocate the maintenance of large amounts of meadowland and wetlands as permanent open space areas essential to the preservation of the fisheries industries and important ground water recharge areas. This project proposes to develop and encourage conservation of the environment for aquaculture purpcses.

In June, 1977, Goodwin also investigated the various career possibilities related to the sea. He examines job responsibilities, duties, skills needed, and location opportunities in the fisheries industry.

The New Jersey Task Force on aquaculture also indicated its desire to create a program designed to capitalize upon the New Jersey seafood industry at the state and national level. This proposal will provide graduates with potential opportunities for employment in this unique primary industry for New Jersey.

B. Body of Report

1. Procedures Used:

The Marine Science Aquaculture Project has as its primary goal the development of job-entry skills in the shell fisheries industry. The first two objectives of the project "To continue to develop in students the job-entry level skills for employment in the shell fisheries industry" and "To continue to provide students with instruction and hands-on experiences in the fundamental processes of spat sowing and setting, growth data collecting, seed clams harvesting, retailing mature shell fish and other skills through infusing but not replacing the existing Marine Science program.

In order to meet the first objective, a committee of teachers, administrators and citizen advisory council members were selected to

Procedures Used (cont.)

review the existing course of study in Marine Environmental Occupations and to make recommendations to expand or modify it to meet the proposed project objectives. The existing course of study was revised and updated in March, 1980 and its organization and content are summarized on the vocational student profile (Table 2) Marine Environmental Occupations.

The Advisory Council was comprised of the county Marine Extension Service agent, a marine biologist for the state of New Jersey, a commercial bay clammer, a commercial surf clammer, a marine biologist for the Division of Fish, Game and Wildlife and a former student (female) employed in the environmental field. The modifications of the existing course of study are summarized in the vocational student profile (Table 1-Shell Fishing Occupations).

The Advisory Council was an integral part of the process of devising the performance test administered to help evaluate effectiveness of the program. The performance test developed during the first year of the project was used again the second year. Individual items on the performance test were developed using the following procedures:

1. Basic job-entry level skills for shell fisheries industry were identified by project director and instructors.
2. Basic skills were then presented to Advisory Council for verification.
3. After basic skills were identified, the following data were gathered about each skill from instructors and Advisory Council:
   a. Is the task critical, essential or not essential to entry-level performance?
   b. How frequently is the task performed on the job: Always, often, or seldom?
4. Outside evaluation of these skills was sought from individuals in state, regional or national organizations associated with the shell fisheries industry.

Procedures Used (cont.)

The results of the performance test will be reported in the section of this report entitled "Findings."

The second set of procedures conducted to meet the objective of development of job-entry skills in the shell fisheries industry was the utilization of laboratory facilities, related instructional techniques and field experiences to teach the skills identified in the process described above.

In order to meet the second objective, the following procedures were conducted:

1. Working in small groups under the supervision of the project instructor, students participated in a series of activities to fulfill the requirements of the program. These activities included but were not limited to the following:

   a. Constructing oyster trays and crab pots and researching appropriate areas for their placement.

   b. Collecting oyster spat (immature oysters) and seed clams in the Delaware Bay during the regular school day.

   c. Relocating the immature shell fish in student-constructed aquafarm areas on school property in the section of the inland waterway known as Great Sound.

   d. Maintaining records in the following areas: rate of growth, water and air temperature, loss due to parasites, time elapsed from placement to marketable size.

   e. Harvesting shell fish, using small boats, clam rakes, oyster tongs and crab pots.

2. Additional activities covering marketing and distribution of shell fish were performed.

The activities for the second objective as evaluated by teacher observation, teacher-made tests, progress charts, and self-assessment evaluations are summarized on the vocational student profile for Shellfishing Occupations (Table 1). The results for both graduates and returning students will be reported in the section of this report entitled "Findings."

Procedures Used (cont.)

The third objective of the project has been "To develop and encourage continuous preservation of unpolluted areas for aquaculture purposes." To foster this objective the following procedures were used:

1. Field trips were taken by students to polluted and unpolluted (protected or preserved) shell fish areas for comparative studies or observations.

2. Identified experts and specialists in the shell fish Industry made presentations to the students to inculcate the traditions of the shell fish industry.

3. Students have reviewed, studied and utilized current print and non-print media addressing the development, expansion and protection of the shell fish industries. A copy of the bibliography developed and used is found in the appendix.

4. Students utilized proper record-keeping techniques essential for monitoring a quality shell fish production operation. (A sample record from the first year of the project is found in Table 3A and 3B)

The results of activities for this objective are reported in the section of the report entitled "Findings."

The fourth objective has been "To assist project graduates employed in Cape May County in contributing to the future economic development of a unique and fundamental industry." To meet his objective, the following procedures were conducted:

1. School guidance and counseling staff assisted potential graduates in identifying job opportunities and requirements in shell fish industries.

2. Detailed career information was provided through the district's career resource center.

3. Project participants became acquainted with the services of the Chamber of Commerce, County Planning Board, County Agricultural Station, County Health Department, Private Industrial Council, and environmental advocacy groups.

The results of these activities are reported in the section of the report entitled "Findings."

TABLE 3-A
OYSTER GROWTH MONITORING FORM RECORD 1981-82

Cage #4 Substratum #9

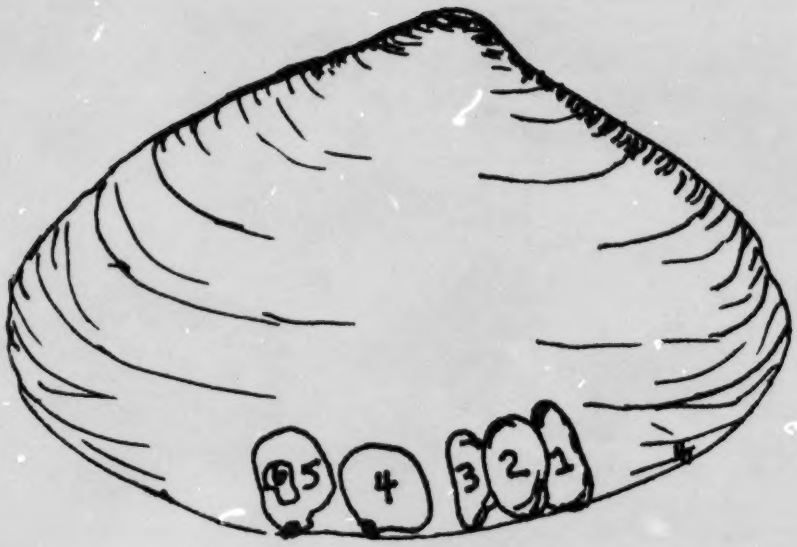
OYSTER #	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL
1		30mm			31mm	33mm
2		27	I C E	I C E	27	28
3		24			26	26
4		31			31	dead
5		31			33	33
6		9			11	14
7		10			12	dead
8		14			14	16
9		13			dead	
10		14			dead	
11		9			11	12
12		13			13	15
13		13			16	17
14		6			dead	
15		13			dead	
16		13			dead	
17		10			10	12
18		10			11	13
19		13			16	dead
20		10			dead	
21		10			10	11
22		8			10	12

TABLE 3-B

OYSTER GROWTH MONITORING FORM - VISUAL

Cage # 4 Substratum # 9

(On Clamshell)



Front

Hinge

Back

Procedures Used (cont.)

The fifth objective of the project has been "To initiate a master course of study for the Shell Fisheries Industry." To meet this objective, the following procedures were followed:

1. A committee will be assembled composed of representatives of teaching staff, administrative staff, and at least one member of the citizen advisory council.

2. The committee will be charged with reviewing the progress of the special project and suggesting the jobs and activities necessary to be included in a potential on future course of study.

3. The committee will suggest a preamble to a master course of study that shall include a statement of philosophy geared to the Marine Environmental and Shellfisheries course. The committee will also suggest several general overall objectives to support the projected master course of study.

2. Findings:

The preparation of the performance test was one of the accomplishments of the first year of the grant. The survey (Table 4) was completed by members of the citizen advisory council, instructors, individuals in the New Jersey Bureau of Shell Fisheries and the National Shell Fisheries Association. Using the Dictionary of Occupational Titles skills were listed for the following job titles:

Shell fish Grower	14 skills
Shell fish-bed Worker	12 skills
Soft Crab Shedder	7 skills
Fisher: Diving	5 skills
Fisher: Line	8 skills
Shell fish Farmer	4 skills
Fish Cleaner	7 skills

The skills formed the base from which to choose the items for the performance test. It was discovered that 13 of the 57 skills (22.8%) received a response of 50% or higher in the non-essential column. Also, 17 of the 57 skills (29.8%) had a response of 50% or higher in the seldom column. The survey found 12 of the 57 skills (21.0) received a response of 50% or higher in both the seldom and the non-essential columns. These twelve skills were eliminated from consideration on the

Table 4

	Importance to job Check one			How frequently used Check one		
	Critical	Essential	Not Essential	Always	Often	Seldom
The following are skills identified for the occupation of shellfish farmer:						
1. Confers with manager to determine time and place of seed planting, cultivating, feeding, and harvesting shellfish.						
2. Plans work schedules according to tidal levels.						
3. Inspects beds and ponds to ascertain the quality of seed distribution, adequacy of cultivation, and completeness of harvesting.						
4.- Oversees maintenance of planting, cultivating, and harvesting equipment, tidal pens, and shellfish beds.						
The following are skills identified for the occupation of shellfish-bed worker:						
1. Loads marking stakes on barge, and moves barge to shellfish bed.						
2. Drives stakes into mud using sledge hammer.						
3. Sows spat by scattering it within staked enclosure.						
4. Covers seeded area with mixture of sand and broken shells of shellfish onto which spat attaches, using a shovel.						
5. Wades in shellfish bed and digs or rakes for shellfish using rake, fork, and spade.						
6. Treads in water and feels for shellfish with bare feet.						
7. Reaches from boat with rake-tongs and gropes for shellfish by moving handles to open and close tongs						
8. Drags brail rod behind powerboat to pull shellfish from mud.						
9. Rigs and lowers dredge into shellfish bed from mast and boom of powerboat, using block and tackle.						
10. Hoists dredge and pulls dump ring to empty catch.						
11. Picks out market size shellfish from catch, and replants smaller ones.						
12. Unloads loose shellfish from boat, using shovel.						

	Importance to job Check one			How frequently used Check one		
	Critical	Essential	Not Essential	Always	Often	Seldom
The following are skills identified for the occupation of fish cleaner:						
1. Scrapes scales from fish with knife.						
2. Cuts or rips fish from vent to throat with knife, and tears out viscera and gills.						
3. Cuts off head of fish with knife, drops head in tub.						
4. Washes blood from abdominal cavity by dropping fish in tub of water and removes discolored membrane from abdomen lining with knife, spoon, scraper, glove, or piece of burlap.						
5. Cuts gashes along sides of fish.						
6. Cuts fish behind gill slits and draws knife along backbone and ribs to free fillet, lays fillet skinside down on table and draws knife laterally between skin and flesh to remove skin.						
7. Slices flesh from bones in fletches.						
The following are skills identified for the occupation of soft crab shedder:						
1. Catching crabs from sea and retaining them in tanks until they molt.						
2. Catches crabs using lines.						
3. Sorts crabs according to stages of shell development.						
4. Puts them into open tanks containing sea water.						
5. Starts pumps to aerate water and maintain constant flow of sea water through tanks.						
6. Observes crabs to ascertain when they begin to shed their brittle outer shell.						
7. Holds shell being shed when necessary, to assist emerging crab that gets hung in shell during molting.						

The following are skills identified for the occupation of shellfish grower:	Importance to job Check one			How frequently used Check one		
	Critical	Essential	Not Essential	Always	Often	Seldom
1. Cultivates and harvest beds of shellfish such as clams and oysters.						
2. Lays out and stakes tide flats.						
3. Piles up stone, poles, and mud.						
4. Makes dikes to control water drainage at low tide.						
5. Removes debris by hand and levels soil with tractor and harrow.						
6. Sows spat by hand or with shovel or sets out strings or baskets of shells onto which spat attach.						
7. Covers seeded area with mixture of sand and broken shells or transfers seeded strings or baskets to growing area.						
8. Rigs net or star mop and drags it over bed behind power boat to entangle and remove shellfish predators, such as crabs and starfish,						
9. Walks about bed at low tide, and scoops or digs shellfish and piles them onto barge or mud sled, using pitchfork or shovel.						
10. Packs shellfish, according to market specifications in containers and returns small ones to bed.						
11. Poles barge to wharf at high tide or pulls it, using boat.						
12. Drags mud sled from bed, using tractor.						
13. May pour oil around bed and spread oil-treated sand over bed with shovel to form chemical barrier to shellfish predators.						
14. May reach from boat with rake-tongs and grope for shellfish by moving handles to open and close tongs						

The following are skills identified for the occupation of fisher, diving:	Importance to job Check one			How frequently used Check one		
	Critical	Essential	Not Essential	Always	Often	Seldom
1. Gathers or harvest marine life, such as sponges, abalone, pearl oyster, and geoducks from sea bottom, wearing wet suit and scuba gear, or diving suit with air line extending to surface.						
2. Climbs overboard or is lowered into water from boat by lifeline.						
3. Picks up oysters.						
4. Places catch in bag or basket and tugs on line to have catch pulled to boat, or surfaces and empties catch on boat or in container.						
5. Signals other workers to extend or retract air lines.						

The following are skills identified for the occupation of fisher, line:						
1. Catches fish and other marine life with hooks and lines.						
2. Lays out line and attaches hooks, bait, sinkers, and various anchors, floats, and swivels, depending on quarry sought.						
3. Puts line in water.						
4. Stows catch in hold or boxes and packs catch in ice.						
5. Hits fish with club to stun it before removing it from hook.						
6. Slits fish, removes viscera, and wash cavity to clean fish for storage.						
7. Steers vessel in fishing area.						
8. When fishing with line held in hand is designated as Fisher, Hand Line.						

performance test. Those twelve skills were Shell Fish Grower #3,4,5,12, and 13; Shell Fish-bed Worker #4,6, and 8; Soft Crab Shedder #7; Fisher: line #8, and Fish Cleaner #5 and 7.

Next a matrix was devised which consisted of the nine possible combinations of responses for each of the 57 skills. (The twelve skills eliminated from consideration on the performance test were included on the matrix.) The category of "No Answer" was, of necessity, added to the matrix. The responses were recorded in the following distribution:

Essential - often - 25.1%
Critical - always - 24.5%
Non-essential - Seldom - 23.7%
Critical - often - 9.3%
Essential - Seldom - 7.8%
No answer - 3.5%
Non-essential - often - 2.6%
Critical - seldom - 2.0%
Essential - always - 8%
Non-essential - always - 3%

One purpose of the matrix was to determine if any skills that were critical or essential were seldom performed. The results showed 9.8% of the responses in these two categories.

Using the information thus gathered, the survey instrument was coded on an item by item basis. Green was used for items in the 60% or more critical or essential category. Red was used for items with 60% or more non-essential. Yellow was used for items falling between these two extremes. The performance test has items either demonstration or paper and pencil corresponding to all the green coded items, many of the yellow coded items and none of the red coded items.

The performance test (Table 5) was administered during the first thirty days and the last 30 days of the second year of the project. The written test consisted of 32 performance items, 10 true-false, 10 multiple-choice items and 10 matching items.

Table 5

AQUACULTURE PROJECT PERFORMANCE TEST

Name of Student _____ Date _____

PART I - PERFORMANCE

Directions: You will be asked to perform the following tasks. There will be some tasks you can perform well and others you may not be able to perform at all. Do each task carefully and to the best of your ability. Your instructors will rate you using the following scale:

E = Excellent	2.50 points
G = Good	2.25 "
A = Average	2.00 "
F = Fair	1.75 "
P = Poor	1.50 "
N = Not performed	0.00 "

1.	Clam rake use	E	G	A	F	P	N
2.	Spat collection	E	G	A	F	P	N
3.	Use of waders	E	G	A	F	P	N
4.	Locating habitat	E	G	A	F	P	N
5.	Reading tides	E	G	A	F	P	N
6.	Making crab pots	E	G	A	F	P	N
7.	Making eel pots	E	G	A	F	P	N
8.	Use of crab pots	E	G	A	F	P	N
9.	Use of eel pots	E	G	A	F	P	N
10.	Boat launching	E	G	A	F	P	N
11.	Rules of road	E	G	A	F	P	N
12.	Use of wet suits	E	G	A	F	P	N

13.	Treading clams	E	G	A	F	P	N
14.	Basic snorkeling	E	G	A	F	P	N
15.	Knot work	E	G	A	F	P	N
16.	Cash register	E	G	A	F	P	N
17.	Basic scuba	E	G	A	F	P	N
18.	Boat docking	E	G	A	F	P	N
19.	Fish preparation	E	G	A	F	P	N
20.	Shellfish preparation	E	G	A	F	P	N
21.	Shedder tank const.	E	G	A	F	P	N
22.	Shedder preparation	E	G	A	F	P	N
23.	Sorting crabs	E	G	A	F	P	N
24.	Reading crab signs	E	G	A	F	P	N
25.	Use of gill net	E	G	A	F	P	N
26.	Net making	E	G	A	F	P	N
27.	Use of CB radio	E	G	A	F	P	N
28.	Making trot line	E	G	A	F	P	N
29.	Using trot line	E	G	A	F	P	N
30.	Fish market	E	G	A	F	P	N
31.	Light salvage	E	G	A	F	P	N
32.	Underwater work	E	G	A	F	P	N

PART II - WRITTEN

TRUE & FALSE - Each correct answer receives .5 points

Indicate with a "+" or "0" whether each of the following statements is true or false

_____ 1. A fish must be scraped with a head to tail motion to remove scales.

_____ 2. To find "red sign" on a peeler crab, examine the tips of the claws.

_____ 3. Soft crabs are always removed from "holding cars" immediately after shedding.

_____ 4. A thin, narrow bladed knife is best for use in filleting a fish.

_____ 5. "White sign" is the final indication that a blue crab is about to molt.

_____ 6. Areas marked "condemned to harvesting of shellfish" are open only to licensed shellfishers.

_____ 7. A bowline is a knot used only on the bow of a vessel.

_____ 8. A fiberlass Professional Fishing Device meets U.S. Coast Guard requirements for "P.F.D.'s."

_____ 9. Female horseshoe crabs are used as eel bait because eels like horseshoe crab eggs.

_____ 10. Scuba divers must breath pure oxygen when diving deeper than 33 feet.

MULTIPLE CHOICE - Each correct answer receives 1.0 points

Complete the following statements with the best answer

_____ 1. Tides are caused by which of the following:

A. Gravitational pull of the sun and the moon
B. Wind direction
C. Distance of the earth to the moon
D. All of the above

_____ 2. Two vessels approaching each other head on should:

A. Give one short blast and pass port to port
B. Give two short blasts and pass starboard to starboard
C. "Heave to" and batten down the hatches
D. A or B
E. None of the above

_____ 3. A zinc bar is attached to steel wire crab pots to:

A. Prevent marine growth from fouling the pot
B. Protect the pot from corrosion
C. Hide the scent of man
D. All of the above

_____ 4. The correct order of peeler crab sign is:

A. Red sign, pink sign, white sign
B. Peeler, shedder, molt
C. White sign, pink sign, red sign
D. Green crab, blue sign, red sign
E. None of the above

_____ 5. The cause of an air embolism is:

A. Over exertion of the heart
B. Holding breath while ascending on scuba
C. Excess hyperventiliation
D. Excess nitrogen in the body tissue
E. All of the above

_____ 6. Goggles are not recommended for use in diving because:

A. The nose is exposed to water
B. You cannot equalize with them
C. They tend to leak
D. They restrict vision
E. None of the above

_____ 7. Decompression sickness or the "bends" is caused by:

A. Supersaturation of nitrogen in body tissue
B. Monoxide combining with hemoglobin thus creating nitrogen excess
C. Long rupture and air forced in bloodstream
D. Excessive deep breathing prior to diving
E. All of the above

_____ 8. The three most dangerous situations that two approaching vessels may encounter are:

A. Sinking, burning, drifting
B. Towing, floundering, aground
C. Passing, head on, crossing
D. None of the above

_____ 9. A vessel's "danger area" is located:

A. From dead ahead to 12 points aft the starboard beam
B. From dead ahead to 10 points port and starboard
C. Just below the gunwales
D. From dead ahead to 10 points aft the starboard beam
E. All of the above

_____ 10. The harvesting of shell fish requires:

A. A long rake
B. A license
C. A good boat
D. Warm water
E. None of the above

MATCHING: Each correct answer receives .5 points

Match the description in Column A with the proper term from Column B. Each term may be used only once and there will be two terms which are not used.

_____	A.	Mature female blue crabs	1. Buster
_____	B.	Blue crab in first stage of molt	2. Colony
_____	C.	Larval stage of oyster	3. Fillet
_____	D.	Clams, oysters, mussels	4. Jimmie
_____	E.	External covering on fishes	5. Net
_____	F.	Immature female blue crab	6. Peeler
_____	G.	Male blue crab	7. Scales
_____	H.	Boneless cut of fish	8. She-crab
_____	I.	Blue crab just prior to molt	9. Shell-fish
_____	J.	Rake like device for shellfishing	10. Sook
			11. Spat
			12. Tongs

PART I sub-score _____

PART II sub-score _____

TOTAL SCORE _____

Findings (cont.)

The performance/demonstration items were performed over a two week period. During the first year of the project, seven of the items (21.) Shedder tank construction, (22.) Shedder preparation, (24.) Reading crab signs, (27.) Use of CB radio, (28.) Making trot line, (29.) Using trot line and (31.) Light salvage, were not tested. This was due to the lack of opportunity to include the teaching of all these skills during the first year of the project. During the second year of the project, two of the items (28.) Making trot line, and (29.) Using trot line were not tested. These items will remain part of the performance test for subsequent years for the purpose of comparison.

The written (paper and pencil) portion of the performance test was administered during a one hour class period. This portion of the performance test consisted of 10 true-false items with a value of .5 per item, 10 multiple choice items with a value of 1.0 per item and 10 matching items with a value of .5 per item. The highest possible score was 20. Student performance range from a high of 20 to a low of 7. The median score was 14.5 and the mean was 13.65.

The performance test was developed as a result of the first year of the project and therefore no pre-test figures exist for the first year. The highest possible score on the performance test (5/15/81) for the first year of the project, when adjusted for the omission of the seven items mentioned above, was 62.5. Student performance range from a high of 59.75 to a low of 22.50. The median score was 44.50 and the mean was 45.52.

Findings (cont.)

The highest possible score on the performance test for the second year of the project when adjusted for the omission of the two items was 75.00. Student performance on the test initiated on 9-16-81 (pre-test) ranged from a high of 53.0 to a low of 29.25. The median score was 46.00 and the mean was 43.50. Student performance on the test initiated on 6-3-82 ranged from a high of 64.25 to a low of 27.25. The median score was 59.25 and the mean was 54.08.

Student performance on each item of the demonstration test was computed by determining an average for each item. The highest possible average was a 2.50 and the lowest was 0.00.

Student performance on the test initiated was best in the following areas:

3. Use of waders - 2.30
1. Clam rake use - 2.20
15. Knot work - 2.18
26. Net making - 2.15
20. Shell fish preparation - 2.11
23. Sorting crabs - 2.10
8. Use of crab pots - 2.10

Student performance on the test initiated 9-16-81 was best in the following areas:

15. Knot work - 2.30
23. Sorting clams - 1.95
1. Clam rake use - 1.90
3. Use of waders - 1.90
6. Making crab pots - 1.90
10. Boat launching - 1.90
18. Boat docking - 1.90

Student performance on the test initiated on 6-3-82 was best in the following areas:

1. Clam rake use - 2.25
8. Use of crab pots - 2.15
13. Tread clams - 2.15
15. Knot work - 2.15
9. Use of eel pots - 2.13
4. Locating habitat - 2.10
5. Reading tides - 2.10
10. Boat launching - 2.10
11. Rules of the road - 2.10

Findings (cont.)

In addition to the seven areas in which performance was not measured on the 5-15-81 test, there were three areas in which so few students were tested that the average was 1.50 or below. The low score was due to lack of performance rather than poor performance. Those areas were:

9. Use of eel pots - .16
17. Basic scuba - .45
32. Underwater work - .45

In addition to the two areas in which performance was not measured on the 9-16-81 and the 6-3-82 tests, there were three areas in which so few students were tested that the average score was 1.50 or below. As in the first year of the project, the low score was due to lack of performance rather than poor performance. These areas on both pre-test and post-test were:

32. Underwater work - .20
31. Light salvage - .20
27. Use of CB - .40

(Interpretation of these scores will appear in the next section of this report).

The written (paper and pencil) portion of the performance test was administered during a one hour class period. This portion of the performance test consisted of 10 true-false items with a value of .5 per item, 10 multiple choice items with a value of 1.0 per item and 10 matching items with a value of .5 per item. The highest possible score was 20. Student performance on the 5-15-81 test ranged from a high of 20 to a low of 7. The median score was 14.5 and the mean was 13.65. Student performance on the 9-16-81 test ranged from a high of 17 to a low of 4. The median score was 11.0 and the mean was 10.9. Student performance on the 6-3-82 test ranged from a high of 19.5 to a low of 4.5. The median score was 16.5 and the mean was 14.85.

Findings (cont.)

Each time the written performance test was administered, an item analysis was also completed. For the purpose of computation of this item analysis, each of the 30 items was assigned a value of 1 for a correct answer and 0 for an incorrect answer. (The weight indicated above for the three sections were not included). Student performance on the 5-15-81 test ranged from a high of 1.00 to a low of .37. The median score was .68 and the mean was .70. Student performance on the 9-16-81 test ranged from a high of 1.00 to a low of .10. The median score was .60 and the mean was .56. Student performance on the 6-3-82 test ranged from a high of 1.00 to a low of .50. The median score was .80 and the mean was .79.

The item analysis of the 5-15-81 test indicated the student performance was best on the following:

True - False - #1
True - False - #7
Multiple Choice - #5
Multiple Choice - #10

Item analysis of the 9-16-81 test showed student performance best on:

True - False - #1
True - False - #4
True - False - #7
Matching - E
Matching - H
Matching - J

The item analysis of the 6-3-82 test indicated student performance best on the following:

Multiple Choice - #9
Matching - B
True - False - #4
True - False - #10
Multiple Choice - #4

Findings (cont.)

Student performance was in need of improvement in the following areas on the 5-15-81 test:

Matching - A
Multiple Choice - #2
True - False - #2

On the 9-16-81 test, the following were in need of improvement:

True-False - #2
True-False - #3
True-False - #8

The 6-3-82 test indicated the following as needing improvement:

True-False - #5
Matching - F

This performance test was the major means of evaluating the first objective "To continue to develop in students the job-entry level skills for employment in the Shell Fisheries Industry."

Another result of the first year of the project was the design of the vocational student profile for shell fishing occupations. While the performance test was an evaluation conducted over a limited period of time, the vocational profile is a summary of activities assessed by various means including teacher observation, teacher-made tests, progress charts, and student self-assessment throughout the entire year. The vocational profile (Table 1) was tallied during the first and second year of the project.

A number of the 1981 graduates did well on the items related to the procedures described under objective 2. All items on which 70% or more of the graduating students were evaluated good or excellent were extracted. These items were:

Shell Fish Terminology
Equipment Identification
Use of Waders
Proper Shellfish Handling
Locating Habitat
Reading Tide Tables
Making Crab Pots

Findings (cont.)

Baiting Crab Pots
Setting Crab Pots
Harvesting Crabs
Equipment Proper Use/Safety
Collection of Shellfish
Pollution Factors
Oyster Tray Construction
Media Utilization
Fish Market Operations

The 1980-81 group which consisted of returning students both sophomores and juniors were also evaluated. Most of the scores for these 1980-81 returning students were in the average to fair range. None of the items for this group had 70% or more of the students evaluated good or excellent. Only one item, Use of Waders, had 60% or more evaluated average or below. This group was evaluated again at the end of the second year of the project.

The students who were evaluated in the second year of the project fell into three categories:

A. Graduates who were in the program for two years.
B. Juniors who were in the program two years
C. Other students, sophomores, juniors or seniors who were in the program for one year.

The group of 1982 graduates did well on a number of items. All items in which 50% or more of the graduates were evaluated good or excellent were extracted. These items were:

Oyster Life Cycle
Crab Life Cycle
Making Crab Pots
Equipment Proper Use/Safety
Small Boat Handling
Outboard Motor Use
Boat Launching
Knot Work

There were no areas in which 50% or more of juniors in the program for two years or the other students in the program for one year were evaluated good or excellent. The overall performance was in the good to average range, as opposed to the average to fair range in the preceding year.

The third objective of the project was "To develop and encourage continuous preservation of unpolluted areas for aquaculture purposes."

Formal field trips to polluted and unpolluted areas were an important aspect of the project. All three project instructors acquired their bus drivers license which facillitated field trips. Trips included the following locales:

Eldora
Delaware Bay-Pierces Point
Lund's Fisheries
Campbell Wildlife Preserve
Avalon Dune Preservation Area
Cape May Point
Cedarville-Skin Diving
Green Bank
Mosquito Point
Electronics Beach

Informal field trips either by foot or by boat were an almost daily part of the instruction. Students were taken to various areas in the vicinity of the Great Sound. Included are Gull Island, Patty's Hole, Townsends Inlet, Sturgeon's Hole and Stone Harbor Point. The clam flats, spat stations and salt marsh (see map 1) were also visited on a regular basis. These formal and informal field trips formed an important part of the instruction. They provided actual work station experience and demonstrated the differences between polluted and unpolluted areas.

Students participated in a number of direct experience activities. They attended presentations by speakers in the shell fish industry and utilized current print and non-print media. The media, which addressed the development, expansion and protection of the shell fish industries were organized into a bibliography which appears in the appendix of this report.

Students also monitored the growth of the shellfish, specifically oyster spat which were transported from Pierce's Point on Delaware Bay. A sample of student records from 1980-81 was presented in Table 3A & 3B. A devastating storm in late October, 1981, caused extensive equipment damage, and problems with ice were experienced in January and February. In the second year of the project a series of oyster growth experiments were conducted. These are discussed in detail in Addendum 1-Oyster Growth Experiments.

The fourth objective of the project was "To provide global opportunities for employment from entry-level to the highly-skilled level for a wide variety of students in this unique and fundamental industry in Cape May County.

There were 10 graduates from the Shellfishing Occupations program in the 1980-81 school year. Two of the graduates were going on for further education. One of the graduates has family responsibilities and is not available for employment. Of the remaining 7 graduates, two are employed in a non-related field, and five are employed in the field.

There were 13 graduates from the Shellfishing Occupation program in the 1981-82 school year. Two of the graduates were going on for further education, and three of the remaining 8 graduates had enlisted in the military; 2 were employed in a non-related field, and 4 were employed in the field.

The fifth objective was "To initiate a master course of study for the shell fisheries industry."

The advisory committee composed of representatives of the teaching staff, administrative staff and the citizens advisory council met and suggested the statement of philosophy and objectives contained in Addendum 2.

3. Interpretation of Findings

A. Using information gathered from a survey (Table 4) completed by members of the citizen advisory council, instructors, and individuals in the New Jersey Bureau of Shell Fisheries and the National Shell Fisheries Association, a performance test was successfully developed (Table 5). This consists of two parts - performance and written. Student performance on the Part I of the post-test administered on June 3, 1982, showed an increase in the high score of 64.25 over the high score of the pre-test of 53.0. Although the low score of the post-test of the 27.25 was slightly less than the low score of the pre-test 29.25, the median score (59.25) and the mean score (54.08) showed an increase over the same of the pre-test. This would indicate an increase in skills on the performance level.

B. The results of the written portion of the performance test administered on June 3, 1982, further indicates an increase in student skills. The post-test high score of 19.5 showed an increase over the pre-test score of 17 administered September 16, 1981. In addition, the low score of the post-test 4.5 was a slight increase over the pre-test score. Consequently, post-test median (16.5) and the mean (14.85) increased over the pre-test scores. Furthermore, the completed item analysis of the written performance post-test showed an increase of the median score and mean score over the pre-test score.

C. The vocational student profile for shell fishing occupations continues to provide evaluation information throughout the school year. The 1980-81 returning sophomores and juniors were re-evaluated in 1981-1982. The scores for the first year were in the average to fair range. Evaluation of profiles during the 1981-82 school year for the same group of students showed an overall performance in the good to average

Interpretation of Findings (cont.)

range. This supports that students in the second year of the program increased their skill performance over their skills acquired the first year of the project.

D. Expansion of field trip sites both formal and informal provided actual work station experience not available at the project site. The results of this expansion has helped students increase skills and supports classroom instruction. In addition, by visiting various sites, students learned about possible opportunities in the shellfishing industries and the job entry skills required.

E. The project in the second year continued to provide students with the necessary job-entry skills to obtain employment in the industry. In 1981 of the 7 graduates available for employment, 5 are employed in the field. Of the 6 students available for employment in 1982, 4 were employed in the shellfisheries industry.

4. Dissemination Activities Planned and/or Implemented

The results of the proposed project will be submitted to the Division of Vocational Education and Career Preparation in Trenton for dissemination to interested vocational schools and associations through established state and federal vocational education information networks. In addition, this report will be shared with the Governor's Aquaculture Task Force by Dr. William Wenzel, Assistant Commissioner of Education, Division of Vocational Education and Career Preparation who is also a delegate to that body. Copies of the project results will also be placed in the vocational district/s media center and career information center, and will be submitted to the County Library for its collection of educational reference materials.

5. Strategies for Elimination of Sex Bias and Sex Role Stereotyping

To eliminate sex bias and sex role stereotyping the following techniques will be utilized:

1. All project students, staff, and supporting counselors will be oriented to the jobs and employment opportunities for both males and females.

2. In all presentations, speakers, experts, or specialists will be requested to use non-sexist language in both live presentations and written deliveries.

3. Written reports will be reviewed to eliminate sexist language.

4. Members of the district Affirmative Action Committee will review print and non-print materials to assure the absence of sexist language or visuals.

C. Summary

1. Conclusions

The two years of the project have had a good impact upon the existing Marine Environmental Program. Student enrollments have increased, special needs students have been included and a great deal of interest for the project has been generated. Funding has provided supplies, equipment, and staff expertise, but more than two years is necessary for the development of a successful program. Students in the program have been able to practice aquaculture skills including seeding shellfish beds, recording growth and harvesting, and retailing the final product. Performance testing has been developed and there has been the opportunity to gather pre-test and post-test data this year.

The project has resulted in a working bibliography (see Appendix) of books, pamphlets, films, filmstrips and transparencies. These print and non-print media continue to supplement the classroom, lab and field work.

The oyster growth project has provided a combination of field and laboratory experiences for students using standardized environmental testing methods.

Summary (continued)

Involvement in the project has provided a variety of vocational experiences to help students choose satisfying careers. Initial placement figures have been included in this final report. It is difficult, however, to make final conclusions based on students who have been in the job market for only one year.

The philosophy and objectives developed in the second year of the project will provide a basis for the generation of a master course of study based on vocational competencies. This is part of the district's overall five year plan to revise existing outline curriculum into competency based curriculum.

This project has balanced the regular Marine Environmental instruction with more in-depth study of shell-fisheries industry. It has provided "career awareness and vocational education" and "job entry-level skills" training as mandated by the T & E process.

2. Recommendations

It is recommended that the instruments developed by the project, specifically the vocational profile and the performance test, continue to be used to assess the long range acquisition of skills in this industry.

It is recommended that areas identified as important for job-entry in the shell fisheries industry but which have not been adequately mastered continue to be emphasized.

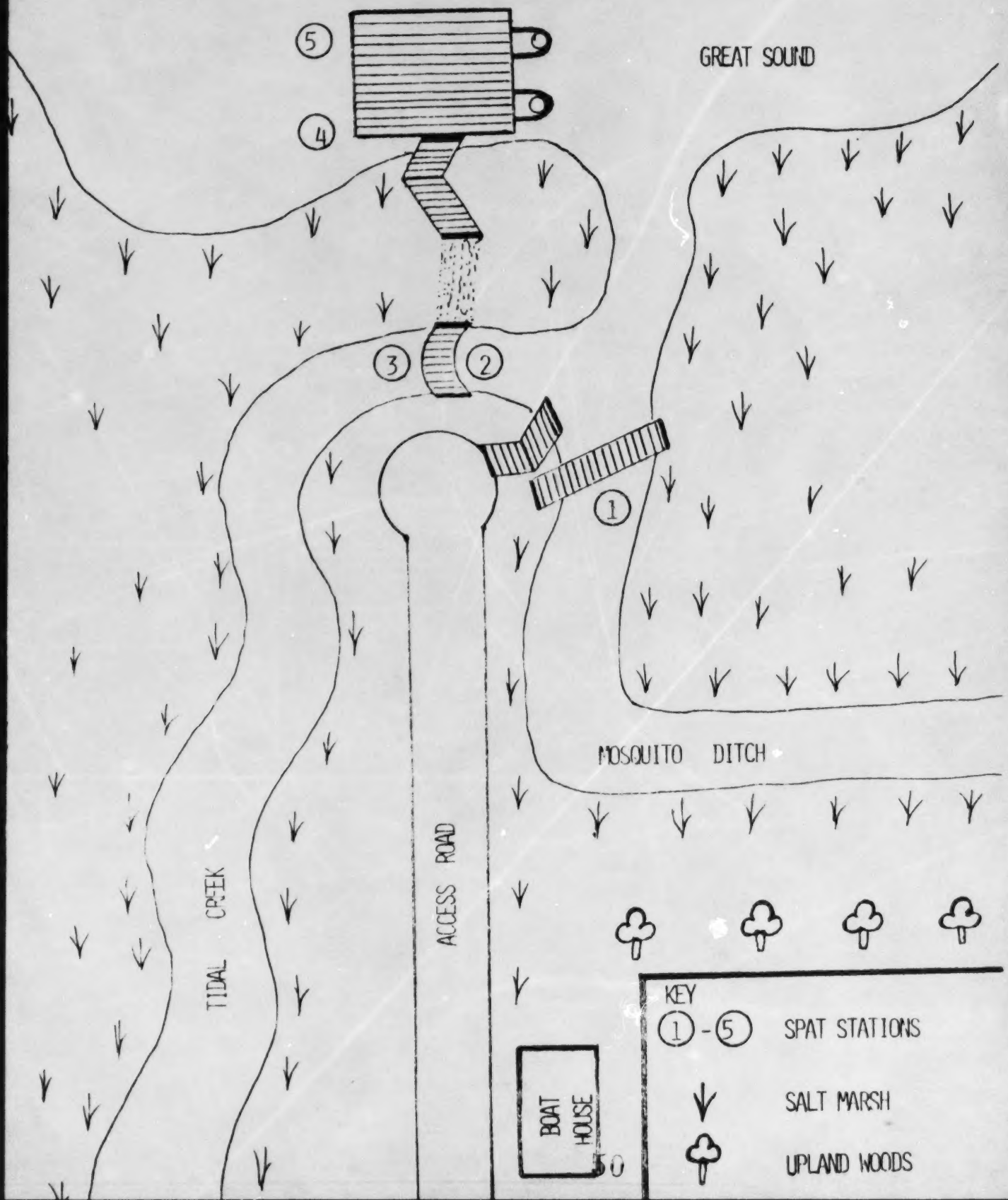
It is recommended that one year and five year follow up studies on the placement of graduates from the program be conducted.

It is recommended that a master course of study be completed as part of the district's five year curriculum revision plan.

Recommendations (continued)

It is recommended that the possibility of initiating a separate, new course in Shell Fishing Industry be considered by the district's Advisory Council.

MAP I - 1980-1981



Addendum 1 - Oyster Growth Experiments 1981-1982

The goals of the oyster growth experiments were to test several different oyster growth sites on the Great Sound to provide the shellfishing project participants with data gathering experience under field conditions. The project was initiated with the collection of oyster spat from Delaware Bay at Pierces Point during October, 1981. Participants were divided in the seven groups each with a different site. (See chart 1-Map B). The beginning date for the experiment was October 20, 1981.

After the sites were selected, each group built oyster trays. (Care was taken to use the same dimensions so that growth at different sites could be compared without biased data from different sized trays). The oyster trays were placed at the sites and the initial weight of a clutch of oysters was taken and recorded. The weights were taken with triple beam balances after oysters were removed from trays at low tide beginning November 20, 1981. The initial weights were:

Groups	Weight
1	452 grams
2	300 grams
3	275 grams
4	492 grams
5	405 grams
6	525 grams
7	327 grams

In addition to the growth experiments, several other plots of oysters were set in various areas without trays. (Chart 2 has the growth records for each site over a six month period).

Environmental factors were taken into consideration and compared. Three specific factors were monitored; temperature, salinity, and dissolved oxygen. Temperature readings were recorded with a

Addendum 1 (cont.)

temperature meter and with surface thermometer. Celsius readings were converted to Fahrenheit. The results appear in Chart 3 - Air and Water Temperature. Salinity samples were taken at each site on a number of occasions. They were taken back to the classroom and analyzed with a Kahlisco induction salinometer. The average salinity is found in Chart 4 - Salinity. The dissolved oxygen readings were taken with La Motte D. O. test kits, using the modified Whikler method. The results from these tests are found in Chart 5 - Dissolved Oxygen. These environmental factors were monitored at all sites on a continuous basis.

Chart 1 - Sites of Growth Experiments

Group	No. Site	Description
1	A	Mouth of creek adjacent to Great Sound
2	B	Salt Pond (1) on Marsh
3	C	Salt Pond (2) on Marsh
4	D	March Creek 100 yards from Great Sound
5	E	Tidal flat in Great Sound
6	F	Upper salt marsh creek near fresh water outlet
7	G	Mosquito Ditch upper salt marsh

Chart 2 - Oyster Spat Growth - 1981-1982

Date	Group 1 Wt. in grams	Group 2 Wt. in grams	Group 3 Wt. in grams	Group 4 Wt. in grams	Group 5 Wt. in grams	Group 6 Wt. in grams	Group 7 Wt. in grams
Nov. 20	452	300	275	492	405	525	327
Dec. 1	455	320	278	490	407	525	325
Dec. 20	467	325	280	495	409	522	320
Jan. 4	467	324	Ice	Ice	Ice	Oysters	Oysters
Jan. 10	Ice	Ice	Ice	Ice	Ice	killed	killed
Jan. 20	Ice	Ice	301	Tray	Tray	at low	at low
Feb. 10	Ice	320	310	Destroyed	Destroyed	tide by	tide by
Mar. 1	Tray	335	340	by Ice	by Ice	frigid	frigid
Mar. 10	Destroyed	342	358	-	-	air	air
April 1	by Ice	375	369	-	-	see	see
April 10	-	382	380	-	-	Chart	Chart
May 1	-	410	410	-	-	3	3

53

54

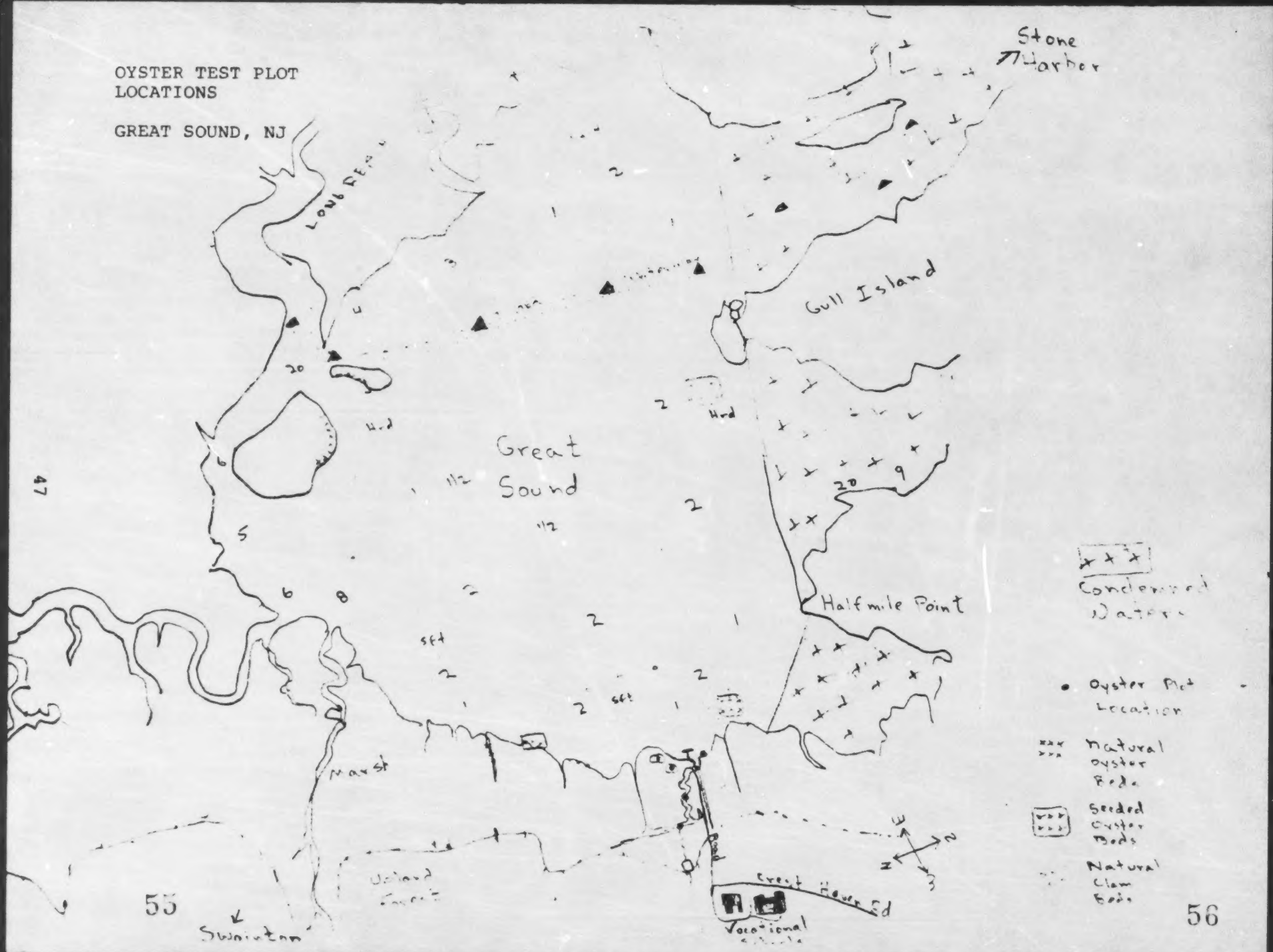

OYSTER TEST PLOT
LOCATIONS
GREAT SOUND, NJ
Stone Harbor
Gull Island
Great Sound
Halfmile Point
Condemned Waters
Oyster Plot Location
Natural oyster Beds
Seeded Oyster Beds
Natural Clam Beds
Crest Haven Rd
Vocational
Swainton
55
56

Chart 3 - Air & Water Temperature Monitoring

	Air Minimum	Air Maximum	Water Min.	Water Max.
Nov.	25	72	30	36
Dec.	18	58	28	32
Jan.	8	39	28	33
Feb.	15	41	* 24	34
March	34	57	33	45
April	52	61	45	58
May	65	75	60	78

* Temperature through ice

Chart 4 - Salinity Monitoring

Average Salinity

Group	Site	Low Tide	High Tide
1	A	9.02 ppt	29.1 ppt
2	B	27.28 ppt	28.1 ppt
3	C	27.01 ppt	27.80 ppt
4	D	7.93 ppt	28.00 ppt
5	E	14.32 ppt	29.42 ppt
6	F	3.92 ppt	28.18 ppt
7	G	4.06 ppt	27.81 ppt

Chart 5 - Dissolved Oxygen Monitoring

Group	Site	D.O.
1	A	9.2 ppm
2	B	8.7 ppm
3	C	9.1 ppm
4	D	7.9 ppm
5	E	9.3 ppm
6	F	8.5 ppm
7	G	7.9 ppm

Results

The data shows that best oyster growth occured in the salt ponds, sites B and C. these were the only trays not affected by the unusually liquid conditions in late December January and February. Growth in the other trays might have been equal or better, but the problems of low tide and cold weather made these sites impractical.

Oxygen content, as seen by Chart 5, was quite high at all sites. No minimum oxygen levels were ever reached, and oxygen content probably was not a factor affecting growth. Summer water temperatures could affect oxygen levels, and further study during the warm months is needed.

Salinity varied greatly, as shown in Chart 4, on all sites except the salt ponds. Constant salinity, but comparisons could not be made because of ice damage.

The other oyster beds, set without trays, sustained less ice damage. Ice plucking was a problem, with ice at low tide lifting and removing oysters on the rising tide.

During the peak of the cold spell, Great Sound was frozen solid, and using a chain saw the ice was measured at 12 to 14 inches thick. Such conditions can cause havoc with shell fish beds and trays. (See Chart 2, group 1, 4, 5, 6, 7) but oysters in more protected areas were able to survive these conditions.

Conclusions

The success of oysters grown in trays in salt ponds, and surviving liquid conditions, was interesting. Natural salt ponds are common in N.J. salt marshes, and represent a possible area for expanded aquaculture pursuits for graduates. Salt ponds can also be man-made for areas that lack them. Salt ponds are sometimes created for mosquito control and such ponds are perfectly suited for aquaculture areas, if the water quality is acceptable.

More traditional oyster beds, such as the areas established by the group as a whole, also showed their ability to survive extremely adverse conditions with some loss due to freezing and ice plucking at low tide.

BIBLIOGRAPHY

I. BOOKS

Amos, William, The Life of the Seashore. McGraw-Hill. 1976.

Bartsch, Paul. Mollusks. Dover. 1968.

Berrill, N.J. The Life of the Ocean. McGraw-Hill. 1966.

Boat Handling. Time-Life Books. 1975.

Braun, Ernest. Tideline. Viking Press. 1975.

Breder, Charles M. Field Book of Marine Fishes of the Atlantic Coast. Putnam. 1948.

Brown, Sam. The Boat Book: Everything of Interest to the Amateur Boatman. Popular Mechanics. 1935.

Carrier, Rick and Barbara. Dive: The Complete Book of Skin Diving. Funk and Wagnall. 1973.

Council for National Cooperation in Aquatics. The New Science of Skin and Scuba Diving. Association Press. 1973.

Cottrell, Ernest. Successful Crabbing. International Marine Publishing Co. 1976.

Cousteau, Jacques. Octopus and Squid: The Soft Intelligence. Doubleday. 1973.

Crawford, William. Boatowners Legal Guide. Haessner Publishing. 1975.

DeGast, Robert. The Oysterman of the Chesapeake. International Marine Publishing Co. 1970.

Dugan, James. Men Under Water. Aulton Press. 1965.

Greenburg, Jerry. Adventures of a Reefcomber. Seahawk Press. 1969.

Grizmek, Bernhard. Animal Life Encyclopedia. Reinhold. 1974.

_____ Grizmek's Encyclopedia of Ecology. Von Nostrand-Reinhold. 1976.

Herald, Earl S. Fishes of North America. Doubleday. 1972.

Kichiss, John M. Oystering from New York to Boston. Wesleyan University Press. 1974.

Koelzer, William. Scuba Diving: How to Get Started. Aulton Press. 1975.

MacInnes, John. Underwater Man. Dodd. 1975.

McLean, David. Hauling Out and Winterizing. Tab Books. 1977.

Migdalske, Edward C., and George S. Fichter. The Fresh and Salt Water Fishes of the World. Knopf. 1976.

Moore, Hilary B. Marine Ecology. Wiley. 1958.

National Academy of Science. Waste Management Concepts for the Coastal Zone. U.S. Goverment Printing Office. 1970.

Outboard Motor Service Manual. Sams, Howard W. and Co. 1970.

Reid, George K. Ecology of Inland Waters and Estuaries. Von Nostrand. 1961.

Reseck, John. Scuba Safe and Simple. Prentice-Hall. 1975.

Rogers, E.L. "Buck". Using Your Boat for Fishing. Aulton. 1959.

Taylor, Herb. The Lobster: Its Life Cycle. Sterling. 1975.

Teal, John. Life and Death of the Salt Marsh. Little and Brown. 1969.

Time-Life Books. The Boat. Silver. 1975.

Time-Life Books. Maintenance. Silver. 1975.

Warner, William W. Beautiful Swimmers: Watermen, Crabs and the Chesapeake Bay. Little. 1976.

II. PAMPHLETS IN MEDIA CENTER FILE

TITLES:

Net Mending and Patching

The Rugged, Independent

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Fisheries as a Profession

Marine Career Series. Marine related occupations, a primer for High School students.

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III. FILMS

A. Free Films

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SCRESC

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NAT GEO

Plankton - 12 minutes

BARR

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IV. FILMSTRIPS

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National Geographic Society, Sea Life. National Geographic Society. 1973.

Gould Center Filmstrips & Cassettes
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V. TRANSPARENCIES

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Tagging fish

Cape May County Vocational Schools
Crest Haven Road, Cape May Court House, NJ 08210

Shellfish Industry - Philosophy and Objectives

SHELLFISHING OCCUPATIONS - COURSE DESCRIPTION

Shellfishing Occupations is open to adults on a full-time basis for one year and to high school juniors and seniors on a half-day, two-year basis. The high school students will spend a half-day in the Career Center and a half-day at the home school and will receive a vocational certificate in addition to a home high school diploma upon successful completion of the program. Adult students will receive a vocational certificate upon completion of the full-time one-year program.

This course is meant to prepare the trainee for entry into the shellfishing industries. Classroom and field ecological studies combine theory with practical "hands-on" experience to broadly qualify the trainee in many career areas. Possibilities include bay and surf clamming, crabbing, mussel collecting, oyster harvesting, eeling and fish market operation. Major areas of study include knowledge of shellfish life cycles and spat collection; field work is done in small boat handling; scuba diving, and shellfish collecting. Included will be the necessary mathematics, related science, business, and English as related subject areas.

Our primary goal is to provide students with job entry skills necessary for gainful employment in the shellfishing field. This kind of knowledge emphasizes both preparation for specific marine related jobs and the development of the personal characteristics and attitudes which are necessary for a successful career:

OBJECTIVES:

1. Given a clam rake, the student must be able to harvest clams at a rate of fifty clams per hour.

2. Given bushel baskets, the student will fill each basket with oyster spat at a rate of one bushel per hour.

3. Given a pair of waders, the student will correctly perform each of the following tasks, adjust for proper fit, inspect for signs of wear, and demonstrate proper maintenance and storage techniques.

4. Given a copy of approved area charts as published by the State of New Jersey D.E.P., the student will correctly identify six specific areas of habitat as either special restricted area, seasonal area, condemmed area, or open to shellfishing.

5. Given a local tide table, the student will list the time of high and low tide for ten specific dates.

6. Given crabpot wire, fasteners, proper tools and a pattern, the student will construct a commercial type crab pot within two hours.

7. Given eel pot wire, fasteners, proper tools and a pattern, the student will construct a 36 inch commercial type eel pot within two hours.

8. Given a crab pot and bait, student will place the bait in the pot, select an area to set the pot, and 24 hours later collect the pot and remove any crabs caught in the pot.

9. Given an eel pot and bait, the student will place the bait in the pot, select an area to set the pot, and 24 hours later collect the pot and remove any eels caught in the pot.

10. Given a tractor, a boat on a trailer and a boat launching ramp, the student will lower the boat and trailer into position and correctly follow a safety checklist for placing the boat in the water.

OBJECTIVES (cont.)

11. Given two model vessels, the student will describe the student will describe the course of action to be taken by each vessel under each of the following circumstances; vessels approaching head on, vessels crossing, and a vessel overtaking another.

12. Given a wet suit and size chart, the student will determine the size of the suit which will best fit them, and display the proper technique for donning a wet suit.

13. Given a wet suit, collection bag and gloves, the student will demonstrate the proper technique for treading clams at a collection rate of fifty clams per hour.

14. Given a mask, snorkel, bouyancy compensator and fins, the student will be able to perform the following exercises, clear flooded mask, clear flooded snorkel, demonstrate two types of fin kicks and use the bouyancy compensator to establish negative, neutral and positive bouyancy.

15. Given a length of line, the student will correctly tie at least four of the following knots: squareknot, bowline, sheet bend, clove hitch, half hitch, and eye splice.

16. Given the Basic Scuba Exam, the student will correctly answer 80% of the questions on the exam within one hour.

17. Given a power boat and dock facility, the student will demonstrate proper judgement of wind speed, current or tide, and relative position to safely bring the boat to dock.

18. Given an unprepared fish and fillet knife, the student will demonstrate the proper technique to bone and skin a fish for market.

19. Given a quantity of shellfish, the student will identify and sort them according to size, specifically chowder claws, cherrystones, top necks, and little necks.

20. Given raw materials, tools and plans, the student will construct a tank to hold shedder crabs until they molt.

21. Given a quantity of soft crabs, the student will sort them by size and properly pack them for market.

22. Given a quantity of hard crabs, tongs, and baskets, the student will determine the size of each crab as a number one or a number two and pack it in the proper basket.

OBJECTIVES (cont.)

23. Given a quantity of crabs, the student will examine each crab and determine the phase of the crabs by establishing the color phase or sign observed and sort the crabs accordingly.

24. Given a gill net and rigging to secure the net, the student will place the net in position and within 24 hours demonstrate the proper technique for collection of the net and removal of the catch.

25. Given net making line, a net shuttle and a spaler, the student will demonstrate the proper technique for tying net knots.

26. Given a CB radio, the student will locate a given channel and use the proper call signals to raise another CB unit.

27. Given line, markers and weight, the student will assemble a 100 ft. trot line with a bait tie every five feet and a weight and marker on each end.

28. Given a trot line, bait, net, and a power boat, the student will bait and set the trot line and within one hour tend the trot line and net the catch.

29. Given full scuba gear and lift bag, the student will locate a submerged object and attach the lift bag and bring it to the surface.

30. Given full scuba gear and collection bags, the student will collect 10 different species of organisms for study and bring them to the surface.